Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 361

Contribution from the Bureau of Animal Industry
A. D. MELVIN, Chief

Washington, D. C. PROFESSIONAL PAPER June 29, 1916

COMPARISON OF THE BACTERIAL COUNT OF MILK WITH THE SEDIMENT OR DIRT TEST.

By H. C. CAMPBELL,
Expert in Milk Hygiene, Pathological Division.

CONTENTS.

	Page.
Utility of the sediment test	1
Object of the work	2
Outline of experiment	2
Method of collecting samples	3
Details of the experiments	3
Details of the experiments—Continued:	
Comparisons with unfiltered market milk	3
Comparisons with filtered milk	5
Conclusions	6
References to literature	6

UTILITY OF THE SEDIMENT TEST.

The sediment or dirt test has been used for some time as a means of detecting visible dirt in milk. It was first applied in Europe to grade the milk as it arrived at the milk-receiving stations. After the milk had passed through the cotton disks they were cut in two, one part being kept for reference and the other mailed to the producer. In this manner it was found to be valuable in inducing the farmer to produce cleaner milk.

During the past few years the sediment test has gained great favor among milk inspectors in this country. They say it has been of great value, as they can actually show the farmer when his milk is insanitary and in this way better fix a standard of prices at the milk-receiving stations. Until recently the grading of milk and cream at receiving stations was based entirely upon such tests as those for per cent of fat, acidity, odor, etc. No test was used whereby any information could be gained regarding the sanitary conditions under which the milk was produced.

Since the discovery of the sediment or dirt test the grading or judging of milk at receiving stations has been of two kinds, chemical and hygienic. It has been the opinion of inspectors that when milk contained sediment or dirt it was insanitary, but until the discovery

of the sediment test they never had a means of quickly determining the exact amount. It has also been a fact long and fairly well established that milk containing sediment or visible dirt, such as manure, hair, etc., was produced under insanitary conditions, but when these ingredients were not present in the milk no field inspector could determine its purity.

Upon the adoption of the sediment test as a means of detecting insanitary milk at the milk-receiving stations, the producers undoubtedly began to use methods calculated to remove the visible dirt. Such methods have been resorted to as straining the milk through cotton, cheesecloth, and Canton flannel to prevent the detection of visible dirt at the station by the field inspector. These methods have so changed the value of the sediment test as a means of judging pure milk that when no sediment or visible dirt can be detected it is often almost impossible to state whether the milk is produced under sanitary conditions or not. In order to determine whether the sediment test could be wholly relied upon as a means of detecting insanitary milk at milk-receiving stations, an experiment was conducted with this purpose in view.

OBJECT OF THE WORK.

The object of this experiment was to prove whether milk containing little or no visible dirt, as often occurs when filtered through certain substances by gravity, was free from a large number of bacteria. It was decided that by comparing the bacterial count with the sediment test (also when milk was filtered through various utensils) certain information could be obtained regarding this point.

OUTLINE OF EXPERIMENT.

Briefly, the experiment was conducted as follows:

Three of what we considered the most practical sediment-test apparatuses were used, namely, the Gerber, the Wizzard, and the Lorenz. The Gerber apparatus was selected because it represents a gravity method. The average length of time required for one pint of milk to pass through the disk by this method was 15 minutes. The Wizzard was selected as a pressure type which could be easily carried for field work and attached to the milk bottle without removing the milk. By this method the time required for the milk to pass through the disk was about two minutes; its disadvantage was that when the pressure was applied there was no means of holding the apparatus securely to the bottle. The Lorenz apparatus was selected as a pressure type in which the milk is placed in the metal container and the pressure applied. The time required by this

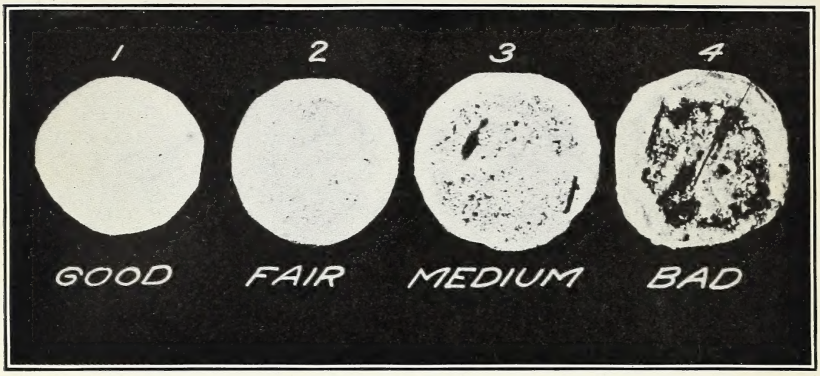

FIG. 1.—COTTON DISKS SHOWING FOUR DEGREES OF SEDIMENT FROM MILK.

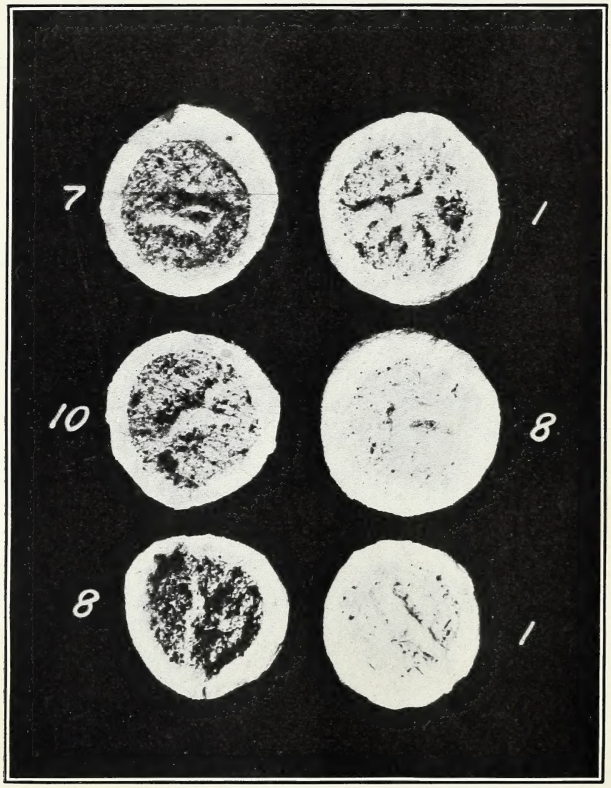

FIG. 2.—COMPARISON OF DISKS IN PAIRS RESULTING FROM THREE KINDS OF SEDIMENT TESTS.

method was also about two minutes, and we found it to be the most satisfactory for field work.

Fifty samples of milk were collected on the railroad station platform from milk cans as they arrived from various farmers throughout the section. Upon arrival at the laboratory the temperature was taken and a bacterial count made. After preparing plates each sample was passed through one of Gerber's sediment tubes. The sediment disks were kept and compared with the bacterial count. A similar comparison was also made with the Wizzard and Lorenz apparatuses, using 50 samples in each case.

After 50 samples had been tested with each apparatus, 20 samples were filtered through 4 pieces of cheesecloth, 20 through one thickness of absorbent cotton, and 20 through one of Canton flannel. Each of these samples was then subjected to the sediment test and a bacterial count made in each case; this was done to determine the effect that straining the milk would have upon the test. We also made a comparison of the filtered samples with the bacterial count after passing them through the cotton disks used in the Lorenz apparatus.

The writer wishes to thank Dr. John R. Mohler, assistant chief of the Bureau of Animal Industry; Dr. Louis A. Klein, dean of the veterinary school, University of Pennsylvania; and Dr. C. J. Marshall, State veterinarian of Pennsylvania, for many valuable suggestions in the work.

METHOD OF COLLECTING SAMPLES.

The milk in the can was thoroughly shaken and 1 pint taken as a sample. The sediment in this kind of sample would, in our opinion, represent the amount of dirt contained in an ordinary bottle of milk. A few inspectors believe that the sample should be collected from the bottom of the cans before shaking, but it seems to us that this may at times be unfair to the producer.

DETAILS OF THE EXPERIMENTS.

In our experiments the character and quantity of sediment upon the cotton disks is represented by the words "good," "fair," "medium," and "bad." (Pl. I, fig. 1.) This gives four classifications, which we considered sufficient for all practical purposes. These classifications are illustrated in Plate I.

COMPARISONS WITH UNFILTERED MARKET MILK.

Table 1 shows the laboratory results obtained by comparing the bacterial count with the Gerber sediment test on 10 average samples out of 50.

TABLE 1.—*Comparison of bacterial count with Gerber sediment test (unfiltered market milk).*

Sample No.	Bacteria per cubic centimeter.	Character of sediment.	Sample No.	Bacteria per cubic centimeter.	Character of sediment.
1	2,690,000	Fair.	6	1,206,000	Fair.
2	1,812,000	Medium.	7	108,000	Bad.
3	1,537,000	Good.	8	263,000	Good.
4	186,000	Bad.	9	1,803,000	Fair.
5	643,000	Medium.	10	319,000	Medium.

In these results it will be seen that some samples had a high bacterial count, yet tested "good" or "fair" with the sediment test, while others which had a low bacterial count tested "medium" or "bad."

Plate I, figure 2 (upper), shows two of the samples—No. 7 and No. 1. No. 7, having a large amount of sediment and classed as "bad," has a low bacterial count, while the other, No. 1, is classed as "fair," and has a high bacterial count.

Table 2 shows the tabulated results obtained by comparing the bacterial count with the Wizzard sediment test on 10 average samples out of the 50.

TABLE 2.—*Comparison of bacterial count with Wizzard sediment test (unfiltered market milk).*

Sample No.	Bacteria per cubic centimeter.	Character of sediment.	Sample No.	Bacteria per cubic centimeter.	Character of sediment.
1	2,131,000	Fair.	6	246,000	Bad.
2	622,000	Good.	7	3,558,000	Fair.
3	1,391,000	Do.	8	4,102,000	Good.
4	812,000	Bad.	9	2,688,000	Fair.
5	377,000	Do.	10	243,000	Bad.

It will be seen here that a greater difference occurred than in the preceding table.

Plate I, figure 2 (middle) shows disk No. 8, classed as "good," containing 4,102,000 bacteria per cubic centimeter, while disk No. 10, classed as "bad," contained only 243,000 per cubic centimeter.

Table 3 shows the tabulated results obtained by comparing the bacterial count with the Lorenz sediment test on 10 average samples out of 50.

TABLE 3.—*Comparison of bacterial count with Lorenz sediment test (unfiltered market milk).*

Sample No.	Bacteria per cubic centimeter.	Character of sediment.	Sample No.	Bacteria per cubic centimeter.	Character of sediment.
1	768,000	Fair.	6	48,000	Fair.
2	99,000	Good.	7	27,000	Do.
3	63,000	Bad.	8	7,200	Do.
4	57,000	Do.	9	329,000	Do.
5	34,000	Do.	10	49,000	Good.

This table, like the others, shows considerable variations; No. 1, which had a bacterial count of 768,000, tested "fair" by the sediment test, and No. 8, which has a count of 7,200, tested "bad." These disks are shown in Plate II (lower).

COMPARISONS WITH FILTERED MILK.

After comparing the bacterial count with the various sediment tests of unfiltered market milk, it was decided to make a comparison after the milk was filtered through such substances as are frequently used as strainers by farmers to remove dirt. Twenty samples were filtered through 4-ply cheesecloth and the Lorenz disks compared with the bacterial count.

The table below shows the results obtained from 10 average samples out of 20, filtering through cheesecloth.

TABLE 4.—*Comparison of bacterial count with Lorenz sediment test (milk filtered through cheesecloth).*

Sample No.	Bacteria per cubic centimeter.	Character of sediment.	Sample No.	Bacteria per cubic centimeter.	Character of sediment.
1	109,000	Good.	6	33,000	Good.
2	67,000	Do.	7	84,000	Do.
3	46,000	Do.	8	93,000	Do.
4	24,000	Do.	9	54,000	Do.
5	639,000	Do.	10	316,000	Do.

Twenty samples were filtered through one ply of Canton flannel and the bacterial count compared with the Lorenz disks. Table 5 shows the results obtained from 10 average samples out of 20.

TABLE 5.—*Comparison of bacterial count with Lorenz sediment test (milk filtered through 1-ply Canton flannel).*

Sample No.	Bacteria per cubic centimeter.	Character of sediment.	Sample No.	Bacteria per cubic centimeter.	Character of sediment.
1	78,000	Good.	6	19,400	Good.
2	31,000	Do.	7	316,000	Do.
3	41,000	Do.	8	129,000	Do.
4	108,000	Do.	9	149,000	Do.
5	18,000	Do.	10	119,000	Do.

Twenty samples were filtered through 1-ply ordinary absorbent cotton, covered above and below with 1-ply cheesecloth. The Lorenz disks were compared with the bacterial count, as in the preceding table. Table 6 shows the results obtained from 10 average samples out of 20.

TABLE 6.—*Comparison of bacterial count with Lorenz sediment test (milk filtered through 1-ply absorbent cotton and cheesecloth).*

Sample No.	Bacteria per cubic centimeter.	Character of sediment.	Sample No.	Bacteria per cubic centimeter.	Character of sediment.
1	760,000	Good.	6	57,000	Good.
2	67,000	Do.	7	362,000	Do.
3	31,400	Do.	8	471,000	Do.
4	42,000	Do.	9	48,000	Do.
5	61,300	Do.	10	191,000	Do.

In every instance in which the milk was filtered through any substances to remove visible dirt the disks were classed as good.

It would seem from the results shown in the last three tables that if milk is strained before applying the sediment test the latter is of little, if any, value in estimating visible dirt.

CONCLUSIONS.

1. The writer considers the Lorenz apparatus the most convenient and practical for demonstrating dirt in milk.

2. The quantity of sediment or visible dirt present on the disk is no criterion as to the kind or number of bacteria contained in the milk.

3. The various sediment tests are applicable only in roughly estimating the quantity of sediment in unstrained milk, and can not be used solely as a means of determining the hygenic conditions under which it was produced.

4. If milk is strained through the substances mentioned, the sediment testers are of little value in estimating the degree of contamination.

REFERENCES TO LITERATURE.

New and Improved Tests of Dairy Products. S. M. Babcock and E. H. Farrington, Wisconsin Station Bulletin No. 195, pp. 3–13.

The Milk Sediment Test and Its Application. A. C. Baer, Wisconsin Agricultural Experiment Station, Circular of Information No. 41.

Experiment with Fliegel's Apparatus for Determining Dirt in Milk. J. Klein, Milchw. Centbl. 1. (1905), No. 7, pp. 305–307.

Comparison of Bacteria in Strained and Unstrained Samples of Milk. H. W. Conn and W. A. Stocking, Storrs Agricultural Experiment Station Bulletin, 1903–1905.

PUBLICATIONS OF U. S. DEPARTMENT OF AGRICULTURE RELATING TO BACTERIAL CONTENT OF MILK.

AVAILABLE FOR FREE DISTRIBUTION.

A Bacteriological Study of Retail Ice Cream (Department Bulletin 303).
The Present Status of the Pasteurization of Milk (Department Bulletin 342).
Care of Food in the Home (Farmers' Bulletin 375).
The Care of Milk and its Use in the Home (Farmers' Bulletin 413).
Bacteria in Milk (Farmers' Bulletin 490).
Production of Clean Milk (Farmers' Bulletin 602).

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C.

The Alcohol Test in Relation to Milk (Department Bulletin 202). Price, 5 cents.
Pasteurizing Milk in Bottles and Bottling Hot Milk Pasteurized in Bulk (Department Bulletin 240). Price, 5 cents.
Relation of Bacteria to the Flavors of Cheddar Cheese (Bureau of Animal Industry Bulletin 62). Price, 5 cents.
The Bacteria of Pasteurized and Unpasteurized Milk under Laboratory Conditions (Bureau of Animal Industry Bulletin 73). Price, 5 cents.
The Milking Machine as a Factor in Dairying, Preliminary Report: 1, Practical Studies of a Milking Machine; 2, Bacteriological Studies of a Milking Machine (Bureau of Animal Industry Bulletin 92). Price, 15 cents.
The Bacteriology of Cheddar Cheese (Bureau of Animal Industry Bulletin 150). Price, 10 cents.
Methods of Classifying the Lactic-acid Bacteria (Bureau of Animal Industry Bulletin 154). Price, 5 cents.
A Study of the Bacteria Which Survive Pasteurization (Bureau of Animal Industry Bulletin 161). Price, 10 cents.
Bacteria in Milk (Separate 444 from Yearbook 1907). Price, 5 cents.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1916